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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/574,052	10/13/2006	Masayoshi Takahashi	B-5926PCT 623364-3	9788

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EXAMINER	
STELLING, LUCAS A	

ART UNIT	PAPER NUMBER
1776	

MAIL DATE	DELIVERY MODE
11/22/2010	PAPER

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	Application No.	Applicant(s)	
	10/574,052	TAKAHASHI ET AL.	
	Examiner	Art Unit	
	Lucas Stelling	1776	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *22 October 2010*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1,2,4-6 and 10-13* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1, 2, 4-6, and 10-13* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☐ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date _____
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____.
5) ☐ Notice of Informal Patent Application.
6) ☐ Other: _____.

DETAILED ACTION

Continued Examination Under 37 CFR 1.114

1. A request for continued examination under 37 CFR 1.114, including the fee set forth in 37 CFR 1.17(e), was filed in this application after final rejection. Since this application is eligible for continued examination under 37 CFR 1.114, and the fee set forth in 37 CFR 1.17(e) has been timely paid, the finality of the previous Office action has been withdrawn pursuant to 37 CFR 1.114. Applicant's submission filed on 10-22-10 has been entered.

Claim Rejections - 35 USC § 112

2. The following is a quotation of the second paragraph of 35 U.S.C. 112:

> The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

3. Claim 2 is rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention. Claim 2 recites the limitation "adiabatic compression-like change." A person having ordinary skill in the art would not know to a reasonable degree either alone, or in light of applicant's specification, whether any given change is "adiabatic compression-like," or not. See e.g., MPEP 2173.05(b)(F), *use of the term "like," for example in the phrase "or like material," to describe a claim limitation is considered indefinite if it is not clear how the element is to be resemble the specified term or terms. See also MPEP 2173.05(b)(C) and 2173.05(b)(E), for related terms to "like" which are considered indefinite because it is not clear what the claim covers.*

Claim Rejections - 35 USC § 103

4. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

5. The factual inquiries set forth in *Graham* v. *John Deere Co.*, 383 U.S. 1, 148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under 35 U.S.C. 103(a) are summarized as follows:

1. Determining the scope and contents of the prior art.
2. Ascertaining the differences between the prior art and the claims at issue.
3. Resolving the level of ordinary skill in the pertinent art.
4. Considering objective evidence present in the application indicating obviousness or nonobviousness.

6. This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

7. Claims 1, 2, 4-6, and 10-13 are rejected under 35 U.S.C. 103(a) as being unpatentable over Chahine in view of Takahashi.

8. As to claim 1, Chahine teaches a method for collapsing microbubbles **(See abstract and see col. 1 line 51, microbubbles are contemplated)**, the microbubbles having a diameter, the method comprising accelerating the speed of the microbubble size decrease and disappearance by applying a stimulation to the microbubbles **(See col. 13 lines 22-30, the jet is directed towards a wall which initates the collapse of the cavitation bubble)**, wherein a great amount of free radical species are released from a gas-liquid interface **(See col. 5 lines 25-40, the collapsing microscopic bubble creates hydroxyl radicals in the liquid in the region of the collapse; and see col. 6 lines 50-52, increasing the overall cavity surface area in contact with water increases the probability that hydroxyls will be close enough to contaminants to react, which means that the hydroxyls will be released at the interface)** by increasing a charge density at the gas-liquid interface of the microbubbles **(See col. 6 lines 1-10, electric discharges are contemplated on collapse, and an electric discharge requires an increase in charge density prior to the discharge)**.

9. Chahine is different from claim 1 in that Chahine does not mention that the bubbles have a diameter of less than 50μm and that when they float in the solution they decrease gradually in size. Takahashi teaches the creation of microbubbles using a swirling fluid microbubble generator to produce microbubbles with a diameter distribution which includes microbubbles having a diameter of 50μm or less **(See Takahashi Figs. 1-3, and see page 2172, left column)**. Takahashi explains that bubbles of this size will naturally shrink while the amount of dissolved gas around the bubble increases **(See Takahashi page 2173)**. Furthermore, Takahashi explains that

the pressure inside the bubble is inversely proportional to the radius of the bubble **(See Takahashi page 2173)**. Moreover, Takehashi contemplates that smaller bubbles will have higher surface areas **(See Takahashi page 2171)**, and Chahine contemplates that the surface area of the cavities is an important factor in determining the production of hydroxyl radicals, and decontamination efficiency of the cavities **(See Chahine col. 6 lines 45-55)**. A person having ordinary skill in the art would have recognized the usefulness of producing small bubbles, below 50μm in order to produce a more energetic collapse. Therefore, it would have been obvious to a person having ordinary skill in the art at the time of invention to operate Chahine to produce microbubbles having a diameter of 50μm or less, as the swirling jet is capable of producing bubbles of that size, and in order to produce higher pressures within the bubble which produces a more energetic collapse, as well as to maintain a large surface area-to-volume ratios for the cavities, thereby increasing the decontamination efficiency.

10. As to claim 2, Chahine and Takahashi teach the method of claim 1, and Chahine contemplates high temperature and pressure collapse of microbubbles in solution **(See col. 5 lines 60-68)**, and the collapse of the bubble occurs due to stimulation caused by a pressure change due to the wall **(See col. 13 lines 22-30; and see also lines 30-42)**.

11. As to claim 4, Chahine and Takahashi teach the method of claim 1, and Chahine contemplates the creation of hydroxyl radical, which constitutes an active oxygen species, which are used for decontamination **(See Chahine col. 1 lines 45-58)**, The high energy collapse of the bubble occurs due to stimulation caused by a pressure change due to the wall **(See col. 13 lines 22-30; and see also lines 30-42)**.

12. As to claim 5, Chahine and Takahashi teach the method of claim 1, and Chahine teaches using cavitation to eliminate organic and other contaminants from the liquids **(See Chahine col. 6 lines 1-10).**

13. As to claim 6, Chahine and Takahashi teach the method of claim 1, and Chahine contemplates using cavitation to treat microorganisms **(See Chahine col. 15 lines 1-15)**.

14. As to claim 10, Chahine and Takahasi teach the method of claim 1, and Chahine contemplates producing cavitation within a nozzle chamber, and then expelling the cavitation pockets out of the nozzle chamber in an annulus of axially flowing liquid **(See e.g. Fig. 5 and col. 12 lines 30-45)**. Chahine goes on to explain that the cavitation nozzles are placed within a cavitation chamber which is connected to a recirculation pipe and pump **(See Figs. 8 and 9 and col. 13 line 56 -- col. 14 line 40)**. Chahine further provides plates, or walls, for causing the collapse of the bubbles **(Chahine col. 13 lines 35-40)**, and further specifies that the plates or walls contain orifices **(See Chahine col. 13 lines 40-42)**. But, Chahine does not specifically mention having the plate w/ orifices installed in the circulation pipe. Nonetheless, Chahine explains that when the swirling vortex with cavitation pockets is sheathed in an annulus of axially flowing liquid, that placement of the collapse inducing surface can be placed farther away from the nozzle outlet in order to extend the time in which cavitation is present while still advantageously causing violent collapse of the cavitation pockets **(See Chahine col. 13 lines 50-56)**. Therefore, it would have been obvious to a person having ordinary skill in the art at the time of invention to place the collapse inducing

surface in the recirculation pipe downstream of the nozzle exit in order to increase the time in which cavitation is present, while still producing violent bubble collapse.

15. As to claim 11, Chahine and Takahashi teach the method of claim 10, and Chahine contemplates pressurizing the system to 60 psi **(Chahine col. 14 lines 35-37)**, which constitutes a pressure of 0.41 MPa.

16. As to claim 12, Chahine and Takahashi teach the method of claim 10, and Chahine teaches that the system is operable at atmospheric pressures **(See Chahine col. 14 lines 30-35)**. Therefore, in order to draw liquid in the negative pressure at the intake side of the pump would be less than the atmospheric pressure.

17. As to claim 13, Chahine and Takahasi teach the method of claim 1, and Chahine contemplates producing cavitation within a nozzle chamber, and then expelling the cavitation pockets out of the nozzle chamber in an annulus of axially flowing liquid **(See e.g. Fig. 5 and col. 12 lines 30-45)**. Chahine goes on to explain that the cavitation nozzles are placed within a cavitation chamber which is connected to a recirculation pipe, which has a pump **(See Figs. 8 and 9 and col. 13 line 56 -- col. 14 line 40)**. Chahine further provides plates, or walls, for causing the collapse of the bubbles **(Chahine col. 13 lines 35-40)**, and further specifies that the plates or walls contain orifices **(See Chahine col. 13 lines 40-42)**. But, Chahine does not specifically mention having the plate w/ orifices installed in the circulation pipe. Nonetheless, Chahine explains that when the swirling vortex with cavitation pockets is sheathed in an annulus of axially flowing liquid, that placement of the collapse inducing surface can be placed farther away from the nozzle outlet in order to extend the time in which cavitation is

present while still advantageously causing violent collapse of the cavitation pockets **(See Chahine col. 13 lines 50-56)**. Therefore, it would have been obvious to a person having ordinary skill in the art at the time of invention to place the collapse-inducing surface in the recirculation pipe downstream of the nozzle exit in order to increase the time in which cavitation is present, while still producing violent bubble collapse.

Response to Arguments

18. Applicant's arguments filed 10-22-10 have been fully considered but they are not persuasive.

19. Applicant argues on page 5 of the remarks that the technology in Chahine produces bubbles by "boiling" caused by the reduction of pressure due to a hydrodynamic mechanism. Applicant goes on to allege that the interior gas of the bubbles in Chahine consist of water moisture. Applicant then argues that the present invention is directed to method in which the tiny bubbles have interior gasses such as air, ozone, and oxygen. In response to applicant's argument that the references fail to show certain features of applicant's invention, it is noted that the features upon which applicant relies (i.e., a bubble of gas such as air, ozone, and oxygen) are not recited in the rejected claim(s). Although the claims are interpreted in light of the specification, limitations from the specification are not read into the claims. See *In re Van Geuns*, 988 F.2d 1181, 26 USPQ2d 1057 (Fed. Cir. 1993). Moreover, applicant's claims to do not appear to exclude bubbles formed from hydrodynamic cavitation of water.

20. Applicant next argues on pages 5 and 6 of the remarks that Takehashi is drawn to a method of producing tiny bubbles which are used in a method of gas hydrate

generation, but that Takehashi does not teach generating free radicals from the bubbles. Applicant then concludes that on a careful review of the review that there is no teaching in Chahine or Takehasi of the method of claim 1 with emphasis added in the remarks to "wherein a great amount of free radical species are released from a gas-liquid interface by increasing a charge density at the gas-liquid interface of the microbubbles." In response to applicant's arguments against the references individually, one cannot show nonobviousness by attacking references individually where the rejections are based on combinations of references. See *In re Keller*, 642 F.2d 413, 208 USPQ 871 (CCPA 1981); *In re Merck & Co.*, 800 F.2d 1091, 231 USPQ 375 (Fed. Cir. 1986). Chahine is cited to show that method of bubble collapse are known within the art, free radical species are produced during the highly energetic collapse interface **(See col. 5 lines 25-40, the collapsing microscopic bubble creates hydroxyl radicals in the liquid in the region of the collapse; and see col. 6 lines 50-52, increasing the overall cavity surface area in contact with water increases the probability that hydroxyls will be close enough to contaminants to react, which means that the hydroxyls will be released at the interface)**. Takahashi is cited to show that swirling fluid is capable of creating microbubbles of 50μm and under. Takehashi is also cited to show that smaller bubbles have higher surface area to volume ratios **(See Takahashi page 2171)**. In addition Chahine contemplates that Chahine contemplates that the surface area of the cavities is an important factor in determining the production of hydroxyl radicals, and decontamination efficiency of the cavities **(See Chahine col. 6 lines 45-55)**.

21. Applicant then goes on, on pages 6 and 7 to argue that Takahashi is concerned with using tiny bubbles in a method of gas hydrate generation, and that Takahashi is not concerned with accelerating the speed of microbubble collapse. In response to applicant's arguments against the references individually, one cannot show nonobviousness by attacking references individually where the rejections are based on combinations of references. See *In re Keller*, 642 F.2d 413, 208 USPQ 871 (CCPA 1981); *In re Merck & Co.,* 800 F.2d 1091, 231 USPQ 375 (Fed. Cir. 1986). Chahine is cited to show that method of bubble collapse are known within the art, free radical species are produced during the highly energetic collapse interface **(See col. 5 lines 25-40, the collapsing microscopic bubble creates hydroxyl radicals in the liquid in the region of the collapse; and see col. 6 lines 50-52, increasing the overall cavity surface area in contact with water increases the probability that hydroxyls will be close enough to contaminants to react, which means that the hydroxyls will be released at the interface)**. Further, Chahine provides for an energetic collapse which is enhanced by a wall or surface **(See Chahine col. 13 lines 22-42)**.

22. Applicant then goes on to argue on page 7 of the remarks that Takahashi is directed to introducing a gas (Xe) into the chamber to create microbubbles, and applicant then alleges that Chahine is concerned with hydrodynamic cavitation. Applicant alleges that Chahine produces bubbles of liquid vapor. First, in response, it is pointed out that the claims do not require any particular gas to be present in the bubbles. Next in response, it is also pointed out that Chahine contemplates the introduction of gases, both oxidative and noble, to the liquid prior to cavitation **(See**

Chahin col. 15 lines 50-60, Chahine contemplates ozone and oxygen gases can be added, and also contemplates noble gasses such has helium, argon and krypton).

23. Applicant again reiterates on pages 7 and 8 that they do not believe that the prior art teaches "wherein a great amount of free radical species are released from a gas-liquid interface by increasing a charge density at the gas-liquid interface of the microbubbles." In response this is shown in Chahine, as discussed above.

24. Applicant argues on pages 8-10 of the remarks that Chahine allegedly teaches away from dependent claims 10 and 13. Applicant argues that since the nozzle in Chahine creates the bubbles, the person having ordinary skill in the art a the time of invention would have been led to locate a wall with or without orifices close to whatever generates the bubbles. In response, applicant cites to Chahine col. 13 lines 22-42 in support of this argument. But, the rejection of claims 10 and 13 are based in part on the teachings of Chahine at col. 13 lines 50-56, wherein Chahine contemplates extending the length of bubble solution travel, by providing the plate w/ orifices farther away, thereby extending the time of cavitation, while still providing an energetic collapse. Therefore, it would have been obvious to a person having ordinary skill in the art at the time of invention to place the collapse-inducing surface in the recirculation pipe downstream of the nozzle exit in order to increase the time in which cavitation is present, while still producing violent bubble collapse.

25. Applicant then argues on page 9 that forming a bubble with a nozzle and shooting it at wall cannot be compared to "accelerating a speed of microbubble decrease and disappearance by applying a stimulation to the microbubbles wherein a

great amount of free radical species are released from a gas-liquid interface by increasing a charge density at the gas-liquid interface of the microbubbles... wherein the stimulation is a compression, expansion and swirling current generated by circulating part of a microbubble-containing solution in a container connected by a circulation pipe to a circulation pump and making the solution path through an orifice plate or porous plate having a single hole or multiple holes, wherein the orifice plate or porous plate is installed in the circulation pipe." In response, the examiner disagrees. The energetic collapse, acceleration and charge density increase caused by a stimulation is shown in Chahine **(See col. 5 lines 25-40, the collapsing microscopic bubble creates hydroxyl radicals in the liquid in the region of the collapse; and see col. 6 lines 50-52, increasing the overall cavity surface area in contact with water increases the probability that hydroxyls will be close enough to contaminants to react, which means that the hydroxyls will be released at the interface)**. Next the microbubbles are formed in a nozzle chamber which is interpreted to be a microbbuble-containing solution in a container **(See e.g. Fig. 5 and col. 12 lines 30-45)**. Chahine also provides that this nozzle chamber is connected to a circulation pipe and is fluidly connected to a pump. **(See Figs. 8 and 9 and col. 13 line 56 -- col. 14 line 40)**. Chahine further provides plates, or walls, for causing the collapse of the bubbles **(Chahine col. 13 lines 35-40)**, and further specifies that the plates or walls contain orifices **(See Chahine col. 13 lines 40-42)**. The only portion of the recited claimed not within the express teaching of Chahine is that the wall is located in the circulation pipe. However, in view of the teaching of Chahine placement of the collapse inducing surface

can be placed farther away from the nozzle outlet in order to extend the time in which cavitation is present while still advantageously causing violent collapse of the cavitation pockets **(See Chahine col. 13 lines 50-56)**, it would have been obvious to a person having ordinary skill in the art to place the orifice plate downstream of the chamber in the pipe in order to extend the time in which cavitation is present while still causing a violent collapse.

26. Applicant next argues on page 10, that it is not obvious to provide a wall with orifice inside a pipe, because there is allegedly no teaching of a wall inside of a pipe in Chahine. In response, "A person of ordinary skill in the art is also a person of ordinary creativity, not an automaton." *KSR*, 82 USPQ2d at 1397. In this case, a person having ordinary skill in the art would have found it obvious to place the plate within the circulation pipe, based on the teachings of Chahine **(See again Chahine col. 13 liens 50-56)** in order to extend the time in which cavitation is present in the water, while still providing an energetic collapse.

27. Applicant also argues that claims 2, 4-6, and 10-13 on the basis that they depend from claim 1 which applicant alleges is allowable. In response, this is not persuasive because claim 1 is rejected, and the arguments with respect to it are not persuasive. Claims 2, 4-6, and 10-13 are also rejected on their own grounds, and any arguments presented are not found persuasive, as discussed above.

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Lucas Stelling whose telephone number is (571)270-

3725. The examiner can normally be reached on Monday through Thursday 12:00PM to 5:00PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Duane Smith can be reached on 571-272-1166. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

Las 11-16-10

/Matthew O Savage/
Primary Examiner, Art Unit 1776